


Date: ESPOO 15.12.2004Page: 1 (14)Appendices 1Number:  
No. 1 / 1**1032471B**Date of handing in: 01.10.2004

Tested by:



Risto Hietanen, Test Engineer

Reviewed by:



Aarni Roth, Application Manager

SORT OF EQUIPMENT:

**The transmitter of the velocity/distance meter system for the bike.**

MARKETING NAME:

**SUUNTO**

TYPE:

**Suunto Bike Pod**

MANUFACTURER:

**SUUNTO OY**

CLIENT:

**Suunto Oy**

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TEST LABORATORY:

**Nemko Oy**

FCC REG. NO.

**91087 August 27, 2001**

IC FILE NO.

**IC 4627 July 2, 2003****SUMMARY:**

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 2 for details.

This test report includes the appendix:

"Occupied bandwidth (99% BW) measurement".

This Test report replaces Test report 1032471 dated on 28.10.2004.

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

### Summary of performed tests and test results

<i>Section in CFR 47</i>	<i>Section in RSS-210</i>		<i>Result</i>
15.249 (a)	6.2.2 (m2)	Field Strength of Fundamental	<b>PASS</b>
15.209 (a)	6.2.2 (m2)	Field Strength of Spurious Emissions	<b>PASS</b>

Explanations:

PASS The EUT passed that particular test.

FAIL The EUT failed that particular test.

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## 1. EUT and Accessory Information

### 1.1 EUT description

EUT is the receiver of the heart rate monitoring system including also the transmitter. The highest internal frequency of the EUT was 2465 MHz. The lowest internal frequency generated was 32768 Hz.

For the facilitation of the spurious emissions tests (for finding of maximum value) the customer delivered also the sample, which transmitted continuously, because duty cycle of the production model is only 0.001 (200  $\mu$ s transmission every 200 ms). Therefore measuring results are peak values. Average level  $\leq$  Peak level – 20 log (duty cycle). (Duty cycle = (200 ms + 200  $\mu$ s) / 200  $\mu$ s = 60 dB). Average level  $\leq$  Peak level – 60 dB.

### 1.2 EUT and accessories

	<i>unit</i>	<i>type</i>	<i>S/N</i>
<i>EUT</i>	<b>The transmitter of the velocity/distance meter system for the bike.</b>	<b>Suunto Bike Pod</b>	-
<i>Power Supply of EUT</i>	<b>Li-Mn Battery 3 V</b>	<b>Varta CR 2032</b>	-

## 2. Standards and measurement methods

The test were performed in guidance of the CFR 47 Part 15, Subpart B, Class B, RS-210, ANSI C63.4 (2001) and EN 55022.

## 3. Test results

### 3.1 Field Strength of Fundamental

The test was performed as a compliance test. The test parameters concerned were as follows:

<i>Site name</i>	Nemko Oy / Perkaa
<i>Date of testing</i>	15.10.2004
<i>Test equipment</i>	350, 42, 525, 543, 184, 403
<i>Test conditions</i>	22.7 °C, 28.1 % RH
<i>Test result</i>	<b>PASS</b>

#### 3.1.1 Test method and limit

Vertical and horizontal polarizations in the frequency 2465 MHz was measured by using the peak detector. During the measurement the turntable was rotated from 0° to 360° and the antenna was raised from 1.0 m and 4.0 m.

Limit 15.249 (a)

<i>Fundamental Frequency</i>	<i>Field Strength of Fundamental</i>	
	<i>(millivolts/meter)</i>	<i>dBμV/m</i>
<b>2465.0</b> <i>MHz</i>	<b>50</b>	<b>94</b>

#### 3.1.2 EUT operation mode

<i>EUT operation mode</i>	<b>TX ON</b>
<i>EUT operation voltage</i>	<b>3 VDC</b>

### 3.1.3 Test data

The measurement results were obtained as described below.  
(measurement distance: 3 m)

$$E [\mu\text{V}/\text{m}] = U_{RX} + A_{CABLE} + AF - G_{PREAMP}$$

Where

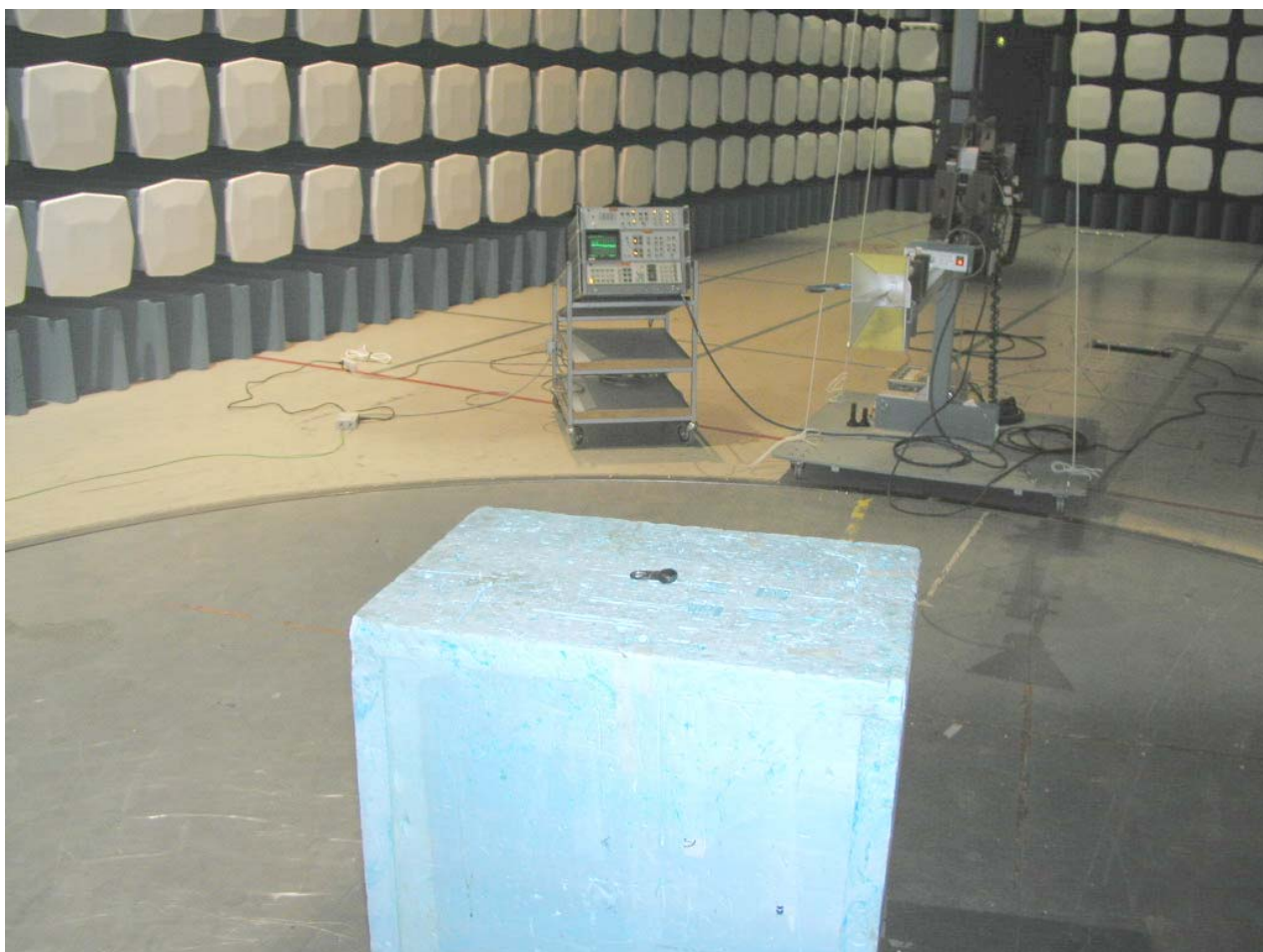
$U_{RX}$  receiver reading

$A_{CABLE}$  attenuation of the cable

$AF$  antenna factor

$G_{PREAMP}$  gain of the preamplifier

### 3.1.4 EUT test setup



Photograph 1. Radiated emissions test setup



Photograph 2. Radiated emissions test setup

**3.1.5 Result**

Frequency	Level (PK) Horizontal/	Level (PK) Vertical	Limit	Remarks
MHz	mV/m	mV/m	mV/m	
2465.0	6.7	2.5	50.00	

### 3.2 Field Strength of Spurious Emissions

Site name	Nemko Oy / Perkaa
Date of testing	18.10.2004 and 15.12.2004
Test equipment	350, 338, 42, 543, 544, 319, 525, 87, 88, 508, 65, 375, 377, 176, 184, 403, 98, 524
Test conditions	22.5 °C. 38.3 % RH and 21.6 °C. 38.0 % RH
Test result	<b>PASS</b>

#### 3.2.1 Test method and limit

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable (photograph 1 and 2). During the test in the frequency range 0.032 - 2500 MHz the distance from the EUT to the measuring antenna was 3 m. During the test in the frequency range 2500 -18000 MHz the distance from the EUT to the measuring antenna was 1.5 m. The excess lengths of the cables of the EUT were made into bundles 30 - 40 cm in length.

Pre scan: Vertical and horizontal polarizations in the frequency range 30 – 1000 MHz was measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0 m and 3.0 m.

Final measurement: During the final measurement the turntable was rotated from 0° to 360° and the antenna was raised from 1.0 m and 4.0 m. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

Vertical and horizontal polarizations in the frequency range 1000 – 18000 MHz was measured by using the peak detector. During the measurement the turntable was rotated from 0° to 360° and the antenna was raised from 1.0 m and 4.0 m.

In the frequency range 18 – 25 GHz the harmonic frequencies are measured with the harmonic mixer using the substitution method. Measuring distance was 1.0 m. Measuring place was the shielded room.

CFR 47 Part 15, Subpart C, (3m measuring distance)

Frequency band MHz	Quasi Peak limit	
	$\text{dB}\mu\text{V}/\text{m}$	$\mu\text{V}/\text{m}$
0.032 – 0.490	$80 + 20\log(2400/F[\text{kHz}]) @ 3\text{m}$	$2400/F[\text{kHz}] @ 300\text{m}$
0.490-1.705	$40 + 20\log(24000/F[\text{kHz}]) @ 3\text{m}$	$24000/F[\text{kHz}] @ 30\text{m}$
1.705-30.0	$40 + 20\log(30) @ 3\text{m}$	$30 @ 30\text{m}$

EN 55022 Class B limit (3m measuring distance)

Frequency band MHz	Quasi-peak Limit $\text{dB}\mu\text{V}/\text{m}$
30 - 230	40
230 - 1000	47

CFR 47 Part 15, Subpart B, Class B (3m measuring distance)

Frequency band MHz	Average limit		Peak limit	
	$\text{dB}\mu\text{V}/\text{m}$	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$	$\mu\text{V}/\text{m}$
1000 - 25000	54	500	74	5000



### 3.2.2 EUT operation mode

<i>EUT operation mode</i>	<b>Transmitter On</b>
<i>EUT operation voltage</i>	<b>3 VDC Li-Mn</b>

### 3.2.3 Test data

The measurement results were obtained as described below.

0.032 - 30 MHz (measurement distance: 3 m)

$$E [\mu V/m] = U_{RX} + AF$$

30 – 2500 MHz (measurement distance: 3 m)

$$E [\mu V/m] = U_{RX} + A_{CABLE} + AF - G_{PREAMP}$$

Where

$U_{RX}$  receiver reading

$A_{CABLE}$  attenuation of the cable

$AF$  antenna factor

$G_{PREAMP}$  gain of the preamplifier

2500– 18000 MHz (measurement distance 1.5 m)

$$E [\mu V/m] = U_{RX} + A_{CABLE} + AF - G_{PREAMP} - C_{1.5m}$$

Where

$U_{RX}$  receiver reading

$A_{CABLE}$  attenuation of the cable

$AF$  antenna factor

$G_{PREAMP}$  gain of the preamplifier

$C_{1.5m}$  correction factory due to 1.5 m measurement distance

### 3.2.4 EUT test setup

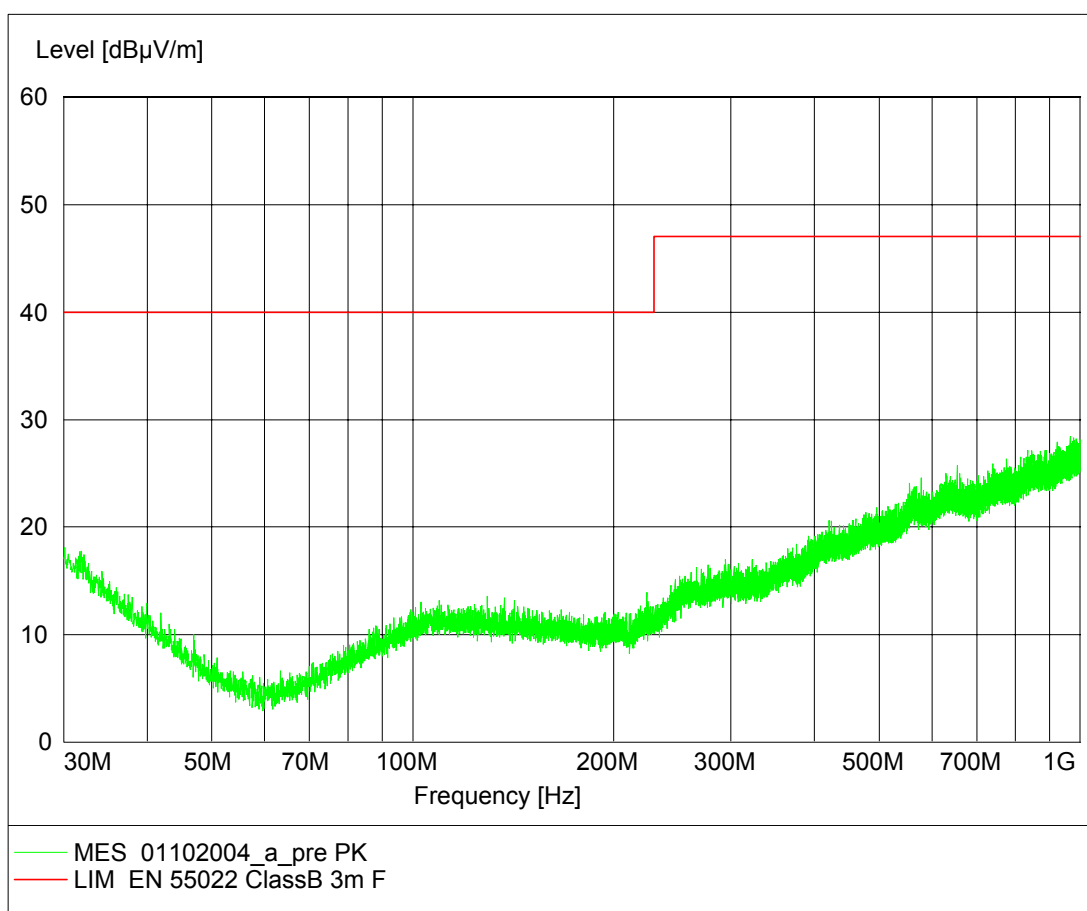
The same as on clause 3.1.4.

### 3.2.5 Spurious emissions results

#### Spurious emissions 0.032 – 30 MHz

Frequency	Level	Margin
MHz	dB $\mu$ V/m	dB
all 0.032-30	< Limit value -20 dB	> 20 dB

#### Spurious emissions 30 MHz – 1 GHz

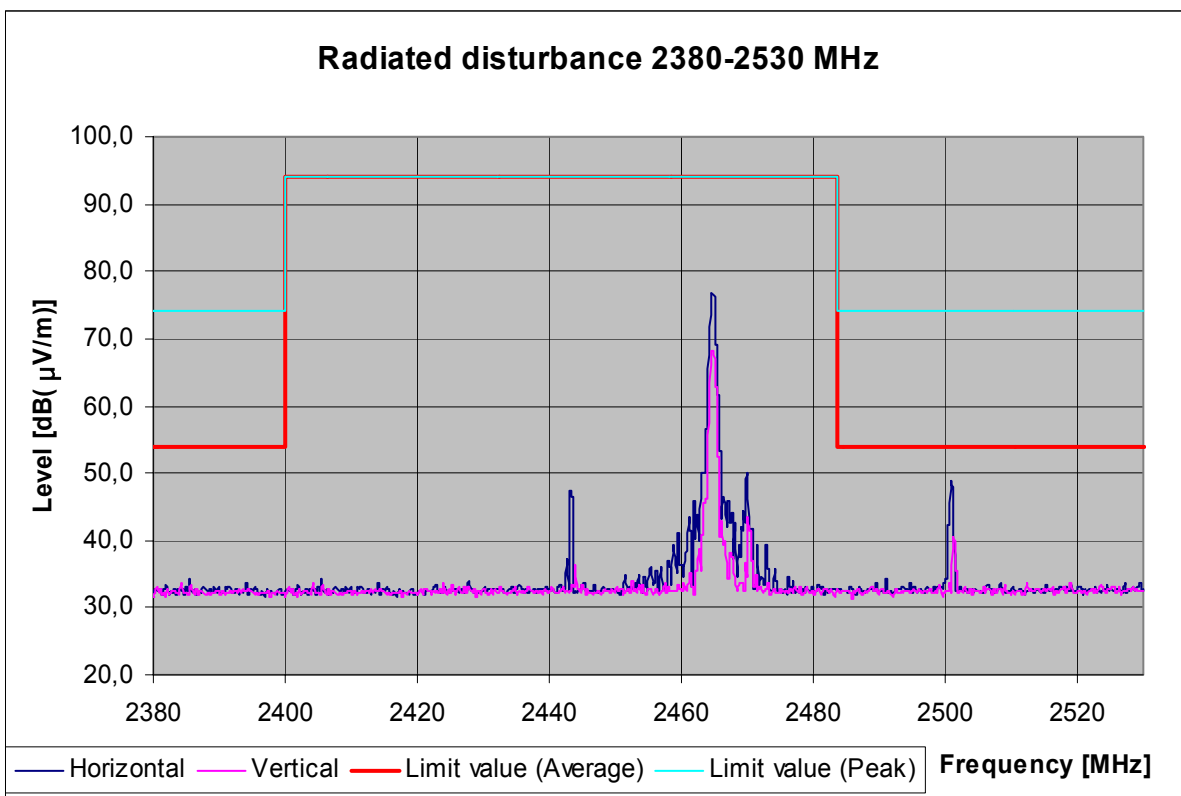


Highest emissions:

Frequency	Level	Limit	Height	Azimuth	Polarisation
MHz	dB $\mu$ V/m	dB $\mu$ V/m	cm	deg	
all 30 to 230	< 18.0	40.0			
all 230 to 1000	< 28.0	47.0			

**Results 2380 MHz - 2520 MHz**

Intermittent duty (Duty cycle: 0,001). TX on 200 ms and TX off 200µs  
 Modulation: ON



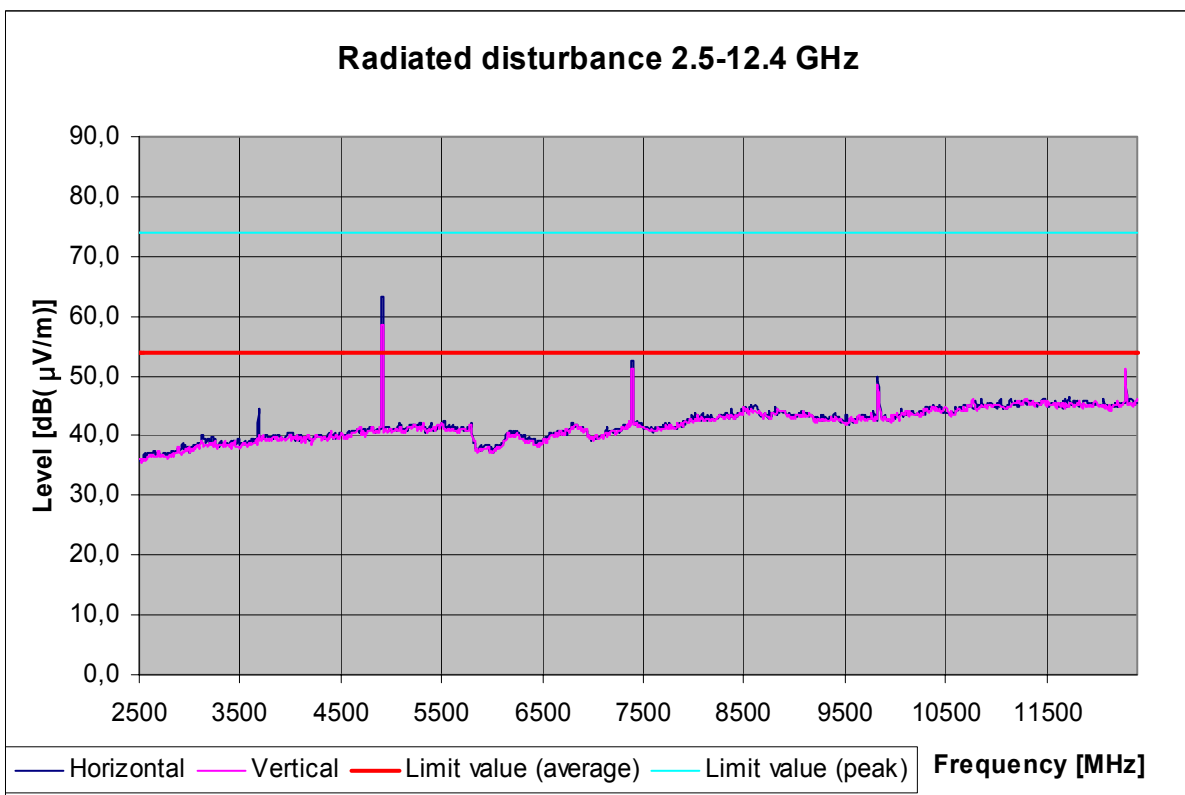
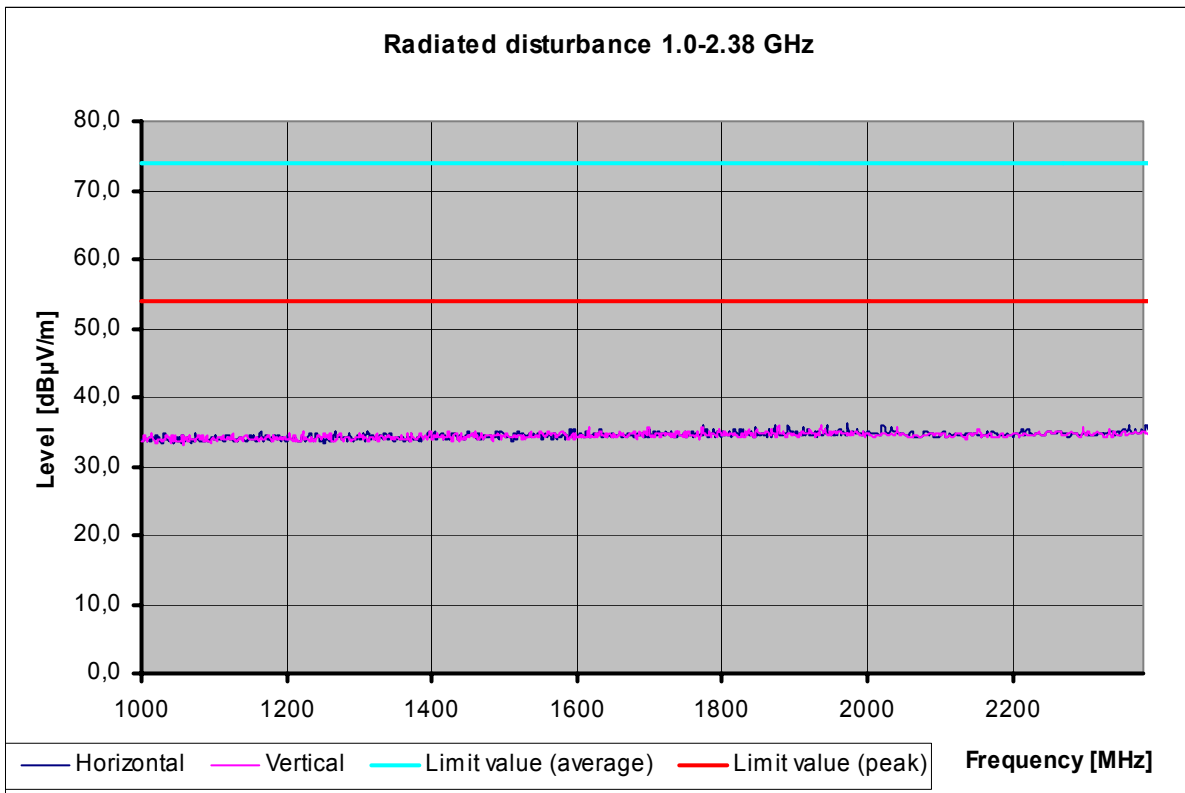
Frequency	Level (PK) Max hold Horizontal	Level (PK) Max hold Vertical	Limit (PK)	Limit (AV)
MHz	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2443.16	47.3	-	94.0	94.0
2470.00	50.2	43.2	94.0	94.0
2500.10	48.7	40.5	74.0	54.0

Note! Peak results!

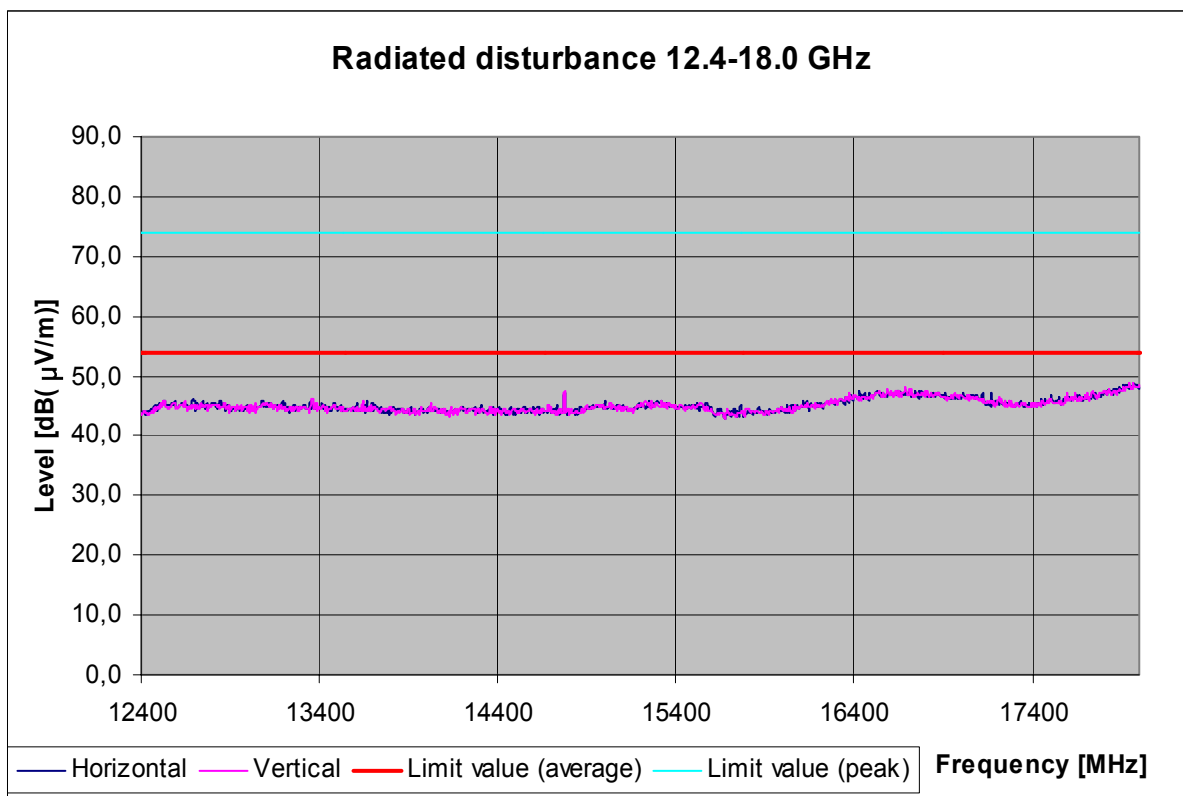
Level (AV) ≤ Level Peak – 20 log (Duty Cycle)

Duty Cycle: 0.001

Level (AV) ≤ Level Peak – 60 dB



**Results of the harmonics**

 Continuous duty (CW)  
 Modulation off


Frequency	Level (PK) Horizontal	Level (PK) Vertical	Limit (PK)	Limit (AV)	Polarization (maximum)
MHz	dBµV/m	dBµV/m	dBµV/m	dBµV/m	
3697.5	44.6	40.1	74.0	54.0	HORIZONTAL
4930.0	63.2	58.6	74.0	54.0	HORIZONTAL
7395.0	52.5	51.1	74.0	54.0	HORIZONTAL
9860.0	49.5	48.5	74.0	54.0	HORIZONTAL
12325.0	50.7	51.2	74.0	54.0	VERTICAL
14790.0	47.3	47.5	74.0	54.0	VERTICAL
17255.0	< 48	< 48	74.0	54.0	
19720.0	< 50	< 50	74.0	54.0	
22185.0	< 50	< 48	74.0	54.0	
24650.0	< 50	< 50	74.0	54.0	

Note! Peak results!

 $\text{Level (AV)} \leq \text{Level Peak} - 20 \log(\text{Duty Cycle})$ 

Duty Cycle: 0.001

 $\text{Level (AV)} \leq \text{Level Peak} - 60 \text{ dB}$

#### 4. List of test equipment

Each active test equipment is calibrated once a year, antennas every 18 months and other passive equipments every 24 months.

Nr.	Equipment	Type	Manufacturer	Serial number
338	Test receiver	ESS	Rohde & Schwarz	847151/009
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
543	RF amplifier	JCA018-501	Mini-Circuits	103
544	RF amplifier	ZFL-1000VH2	Mini-Circuits	D01080
87	Antenna	639	Narda	7909
88	Antenna	638	Narda	8003
319	Antenna	CBL6112	Chase	2018
525	Antenna	3115	Emco	6691
508	Harmonic Mixer	11970K	Hewlett Packard	2332A01907
65	RF amplifier	6616-605N	Hewlett Packard	2005A01452
508	Harmonic Mixer	11970K	Hewlett Packard	2332A01907
375	RF attenuator PAD	757 C - 20 dB	Narda	
377	RF attenuator PAD	757 C - 20 dB	Narda	
184	Temp. & humidity meter	H MI 32	Vaisala	63837
403	Processmeter	787	Fluke	6975028
176	Shielded room	888 X 585 X 416 cm	Euroshield Oy	-
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327
524	Active Rod Antenna	3301B	Emco	4432
98	Antenna	HFH2	Rohde & Schwarz	871336/45